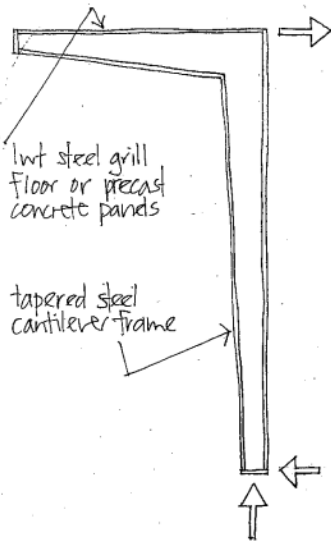


Concrete Sketch Book

June 2012

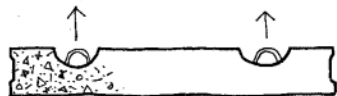
2m Walkway:

steel cantilever frames tied back to main frame



3,5m Service Way:

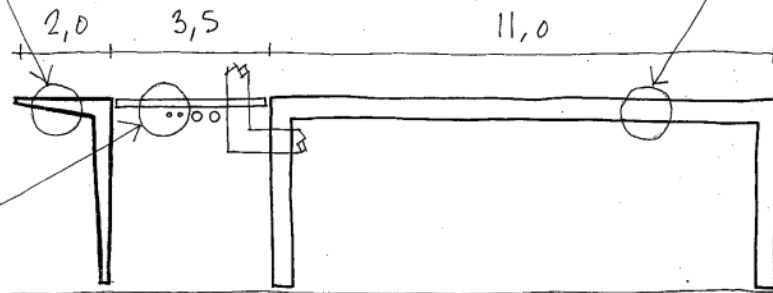
precast concrete floor planks with lifting eyes for future removal.



3,5m span solid p.c. planks 100mm thick cast with lifting eyes.

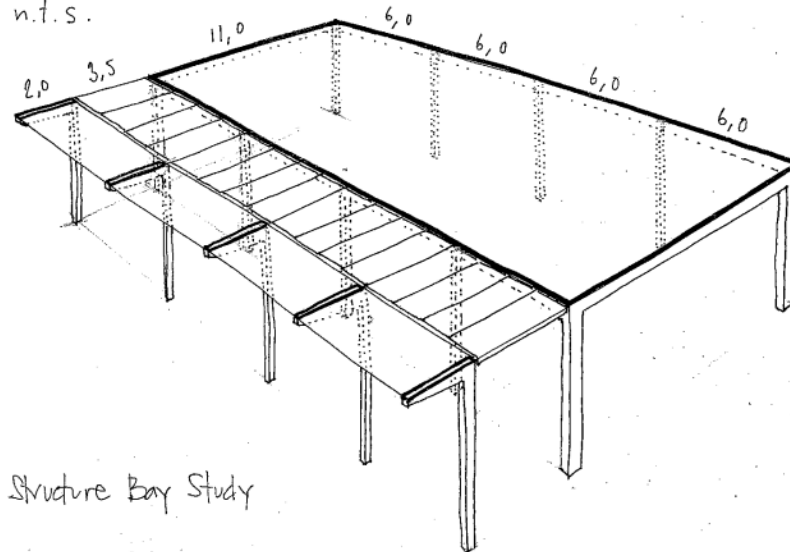
Section:

1:100



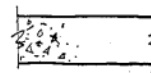
Iso:

n.t.s.



11m Lab Module:

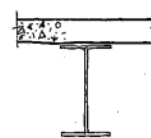
11x12m lab space with 11x6m structure grid?



350mm PT flat slab



600mm insitu rib slab



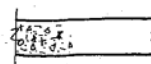
600mm + r.c. slab



320mm prestress hollow core plank

11m clear span provides flexibility in lab layout however detail review of vibration/dynamic response req'd for support of specialist lab equipment

11x12m lab space with 9,5x6m structure grid?



250mm insitu flat slab

Notes:

1. Detail review of vibration/dynamic response of structure req'd. Check to BS 6472 and HTM 2045.

whitbybird

Structure Bay Study

Physics for Medicine

W01223369220 Fax 01223355215 Cambridge@whitbybird.com
www.whitbybird.com

Scale:

1:100 @ A3

Date:

Sept 2005

Drawn:

SM

Checked:

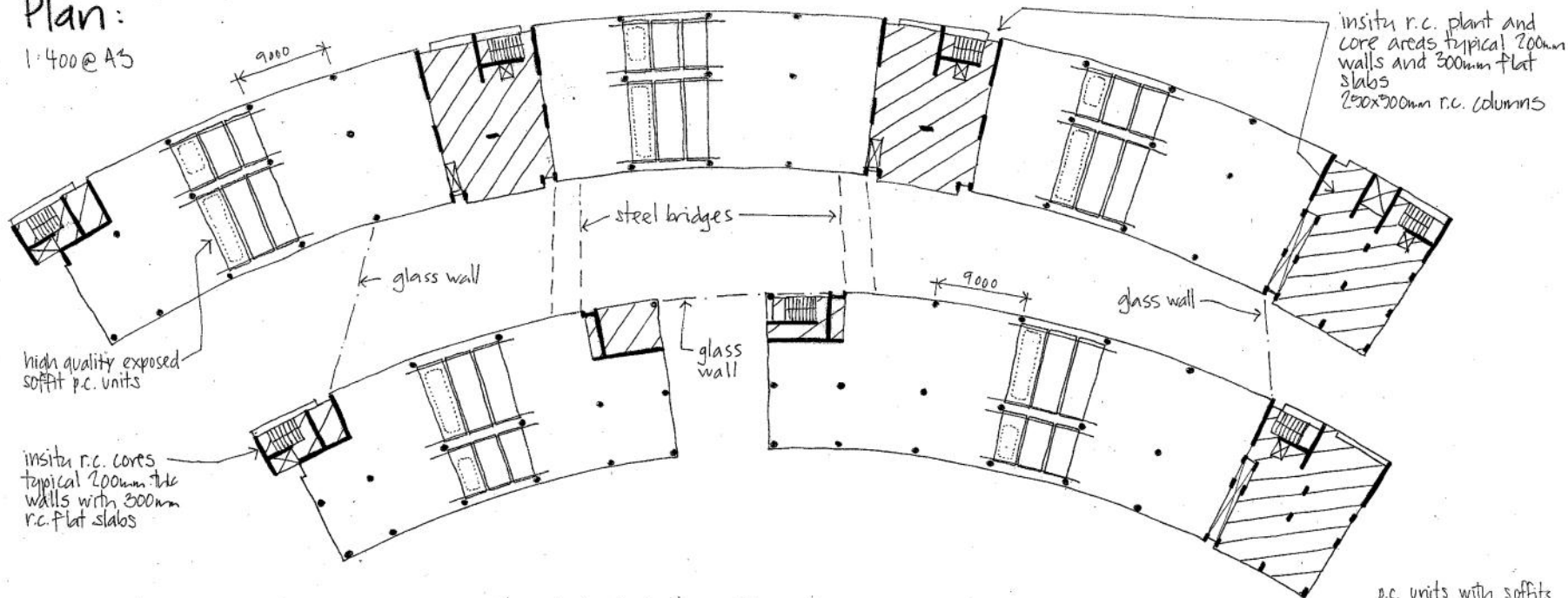
Rev:

Drawing:

3983/SK/001

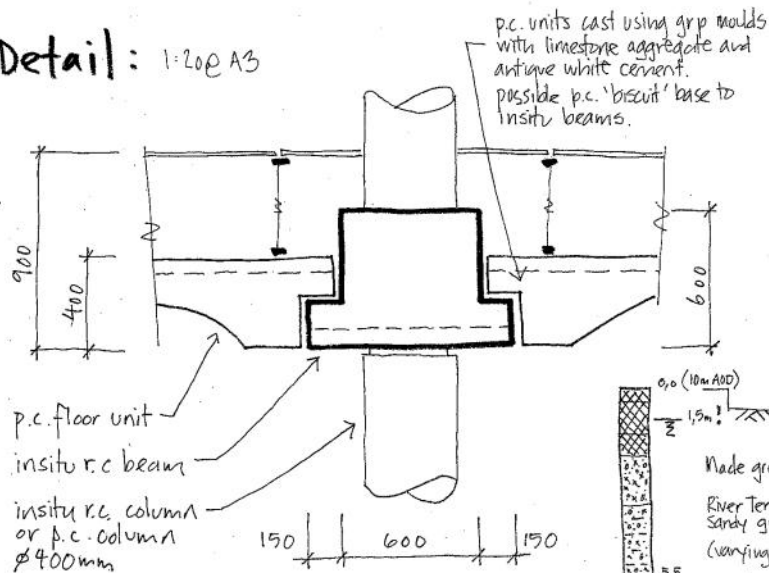
Plan:

1:400 @ A3



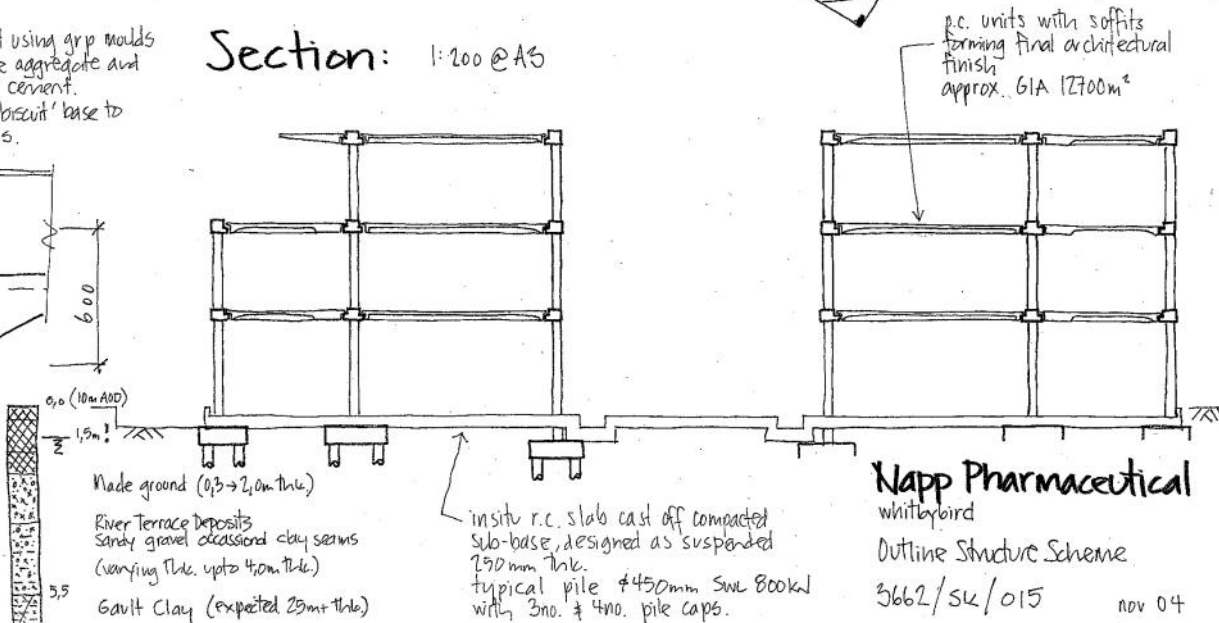
Detail:

1:200 @ A3



Section:

1:200 @ A3



Napp Pharmaceutical

Whitbybird

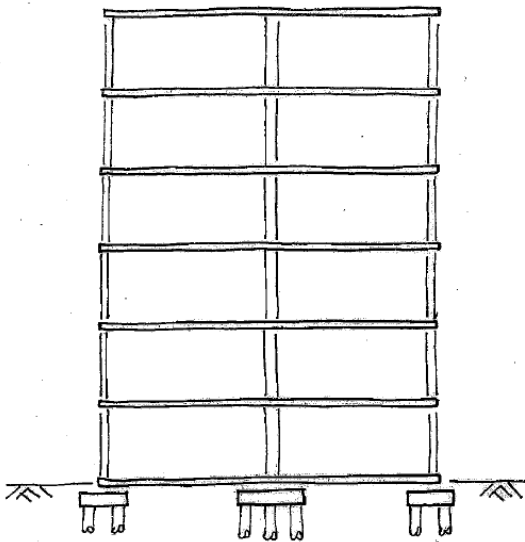
Outline Structure Scheme

3662/54/015

nov 04

Section:

6 storey insitu r.c. frame building



- 6 storey insitu concrete framed building
- high quality formwork req'd to achieve acceptable soffit finish
- insitu or precast circular columns
- totally flat soffit
- ground bearing r.c. slab
- piled foundations

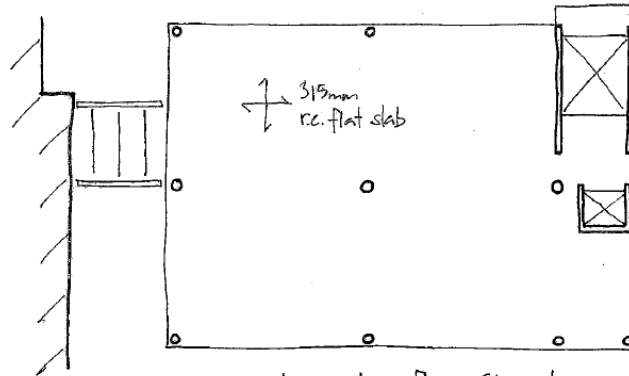
Key Design Data:

imposed floor load (book stack)
fit out/finishes (services, screed...)

6.5 kN/m²
2.25 kN/m²

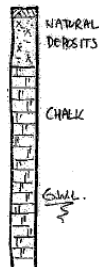
Plan:

8.4m x 6.85m column grid
bracing/stability review req'd



concrete grades floors C40 columns C50

columns: internal $\phi 610\text{mm}$
edge $\phi 500\text{mm}$

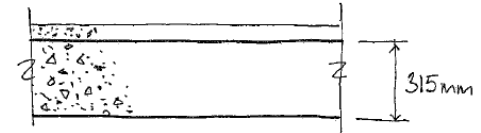


Notes:

1. r.c. insitu flat slab depth 315mm
C40 concrete fy 460 rebar
allow 38 kg/m³ rebar with shear links
2. insitu or precast concrete columns
C50 concrete fy 460 rebar
internal $\phi 610\text{mm}$ rebar 95 kg/m
edge $\phi 500\text{mm}$ rebar 75 kg/m
3. ground bearing slab (250mm r.c. insitu)
to support dense mobile racking subject to
results of site investigation
4. cfa pile foundations with pile caps
typically $\phi 450\text{mm}$ 20m long approx. 80no.

Detail:

flat soffit to aid services
distribution

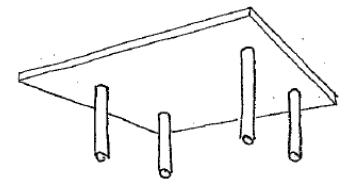


315mm insitu r.c. flat slab with
exposed soffit.
high quality resin faced plywood
formwork with formwork layout/
panel layout set by architect
concrete mix developed with contractor
to gain good consistent colour soffits.

75mm non structural screed for
floor trucking

ind. clt + il weight = 16.1 kN/m²
[total weight of bldg say 4000kN]

Is:



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ENGINEERS

Janus House 50 St Andrews Street
Cambridge CB2 3AH

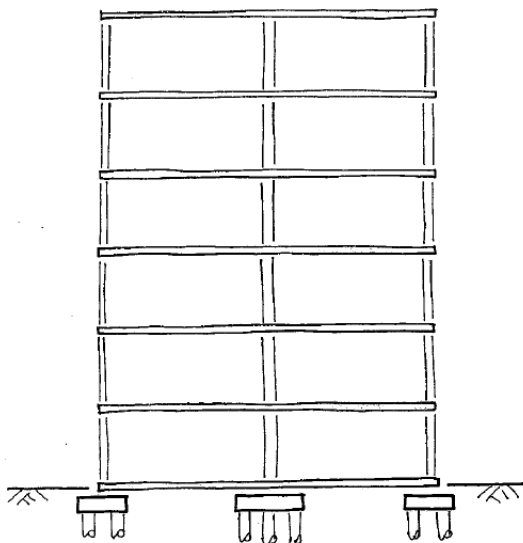
tel +44 (0)1223 369 220 fax +44 (0)1223 356 215
email: cambridge@whitby-bird.co.uk www.whitbybird.com

UEA Central Library Extension Project

Structural Scheme Design Option 2

Rev	Description	Date	By	Chk
Scale:	n.t.s.	Date:	May 2003	Drawn:
Drawing No:	2960/SK/005	Checked:	SSmith	Rev:

6 storey hybrid v.c. frame building

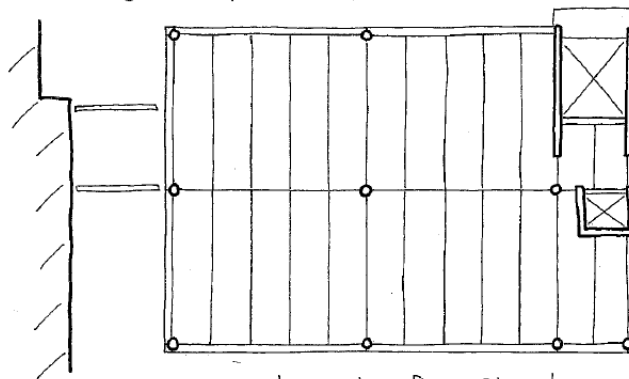


- 6 storey hybrid concrete framed building
- high quality precast concrete soffits with predetermined joint layout
- in situ or precast circular columns
- totally flat soffit
- ground bearing r.c. slab
- piled foundations

imposed floor load (book stack)
fit out/finishes (services, screed..)

$$\begin{aligned} 6,5 \text{ kN/m}^2 \\ 2,05 \text{ kN/m}^2 \end{aligned}$$

8.4m x 6.05m column grid
bracing/stability review req'd



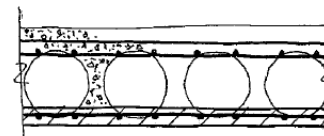
concrete grades floors C40 columns C50

columns: internal $\phi 590\text{mm}$
edge $\phi 480\text{mm}$



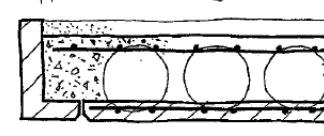
1. hybrid concrete flat slab dp. 340mm
c40 concrete fr 460 rebar
rebar quants to buttdeck info.
2. insitu or precast concrete columns
c50 concrete fr 460 rebar
internal $\phi 570$ mm rebar 90 kg/m
edge $\phi 480$ mm rebar 75 kg/m
3. ground bearing slab (250mm r.c. insitu)
to support dense mobile racking Subject to
results of site investigation
4. of a pile foundations with pile caps
typically $\phi 450$ mm 2m long approx. 70ns.

flat/exposed softit to aid services distribution



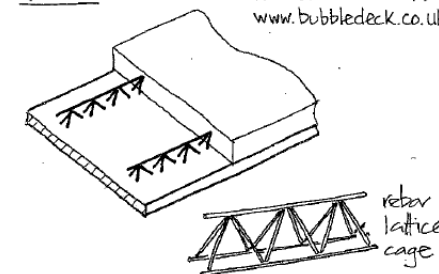
340mm hybrid concrete flat slab
bubbledeck system
precast soffit panels which form
temporary and permanent 'shuttering'
to insulate 'topping'
concrete saving ~30% using hollow
circular ball formers cast into
precast units.
system requires temp. prepping @ 30m

typical slab edge:



150:

More info:
tel 020 7877 8575
www.bubbledeck.co.uk



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ENGINEERS

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WEA Central Library Extension Project

Structural Scheme Design Option 4

Rev	Description	Date	By	Ch
Scale:	Date:	Drawn:	Checked:	
n.t.s	may 2003	sgs		
Drawing No:				Rev:
2960/SK/007				

Outline Design:

assume 240mm PT flat slab

loading:			
SWT slab	575		
finishes	1,00		
ceiling	0,50		
int partitions		1,00	
floor live load		1,50-2,00	
SLS	7,25	3,00	10,25
ULS	10,15	4,80	14,95
ULS (50% IL red)	10,15	3,20	13,35

Core:

$$\text{load area} = 12,0\text{m} \times 11,0\text{m} = 132\text{m}^2$$

$$\times 35 \text{ Floors} = 4620\text{m}^2$$

$$\text{floor ULS (50\% IL red)} = 63\text{MN}$$

$$\text{core SWT ULS (400mm)} = 42\text{MN}$$

$$\text{concrete stress (1,4 DL + 1,4 WL)} = 32\text{N/mm}^2$$

$$42\text{N} + 3\% \text{ rebar } 26\text{N/mm}^2$$

$$50\text{N} + 4\% \text{ rebar } 33\text{N/mm}^2$$

i.e. 400mm thick core walls

Columns:

$$\text{internal column load area} = 7,5\text{m} \times 6,5\text{m} = 49\text{m}^2$$

$$\times 35 \text{ Floors} = 1715\text{m}^2$$

$$\text{floor ULS (50\% IL red)} = 23,5\text{MN}$$

i.e. 900x900mm column

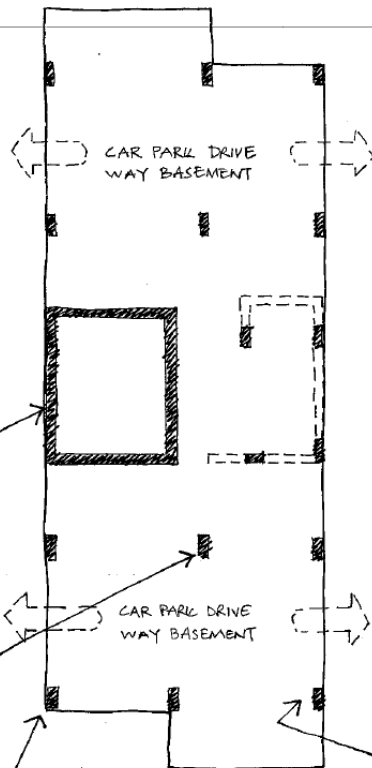
$$\text{edge column floor ULS (50\% IL red)} = 12\text{MN}$$

$$\text{cladding} = 1\text{MN}$$

i.e. 675x675mm column

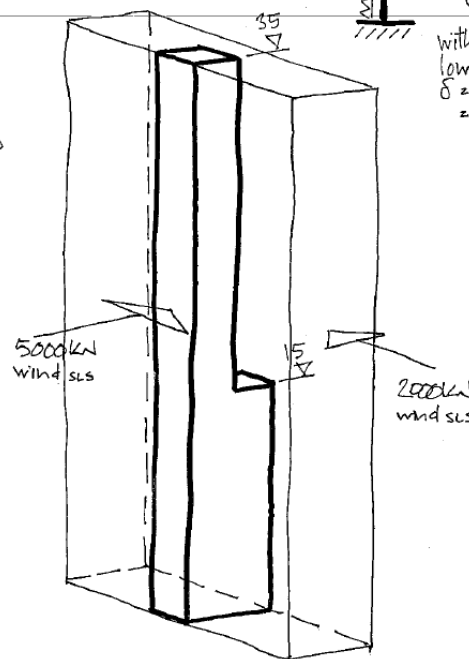
Plan:

1:250 @ A3



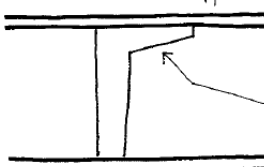
precast or insitu end columns with 'arm' to stiffen 3m cantilever slab edges

Stability:



Detail:

cantilever slab stiffeners



3m slab cantilever stiffened by column 'arms.'

columns built with 'arms.'

$$\delta = \frac{Wl^4}{8EI}$$

$$= 480\text{mm}$$

$$(l = 120\text{m})$$

$$(I \text{ constant})$$

with 1,5x I to lower 15 floors

$$\delta = 340\text{mm}$$

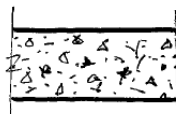
$$= h/350$$

Bay Study:

8x8m

① insitu flat slab 290mm

② insitu PT slab 240mm



4x4m

① insitu flat slab 200mm

note: transfers req'd over carpark

Core calcs:

assume 8m x 6,7m hollow box:
350mm walls $Z = 16\text{m}^3$ $I = 70\text{m}^4$ $A = 9,8\text{m}^2$
400mm walls $Z = 18\text{m}^3$ $I = 77\text{m}^4$ $A = 11,1\text{m}^2$

$$M_{\text{wind ULS}} = 60\text{m} \times 5000\text{kN} \times 1/4 = 420\text{MNm}$$

$$\sigma_{\text{bus}} = 23\text{N/mm}^2$$

* note widening of core in hotel will reduce this σ_b

$$\text{concrete stresses} = N = 0,4f_{cu}A_c + 0,75A_s f_y$$

Notes:

1. building assumed with sprinklers and height < 120m (structure 2hr fire protection)

2. further study req'd on stability core and effect of openings and vertical load efficiency.

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www.whitbybird.com

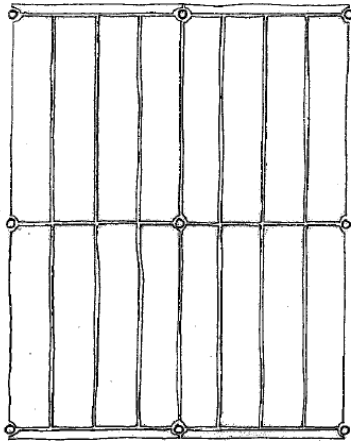
Princes Dock, Liverpool

Structure Study - Concrete

Rev	Description	Date	By	Chk	
Scale:	1:250 @ A3	Date:	March 06	Drawn:	Checked:
Drawing No.:	00020/SK/001			Rev:	

Plan:

(of precast soffit panels)



Structural grid 9,0x7,2m

Careful arrangement of pre-cast units allows quality exposed soffit

hybrid construction achieved using precast soffit panels which form temporary and permanent 'shuttering' to insitu 'topping'

floor thk. 330mm

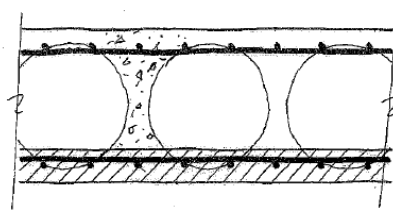
internal column $\phi 450$ mm
75 kg/m rebar

perimeter column $\phi 400$ mm
75 kg/m rebar

C40 concrete fy460 rebar

Section:

(of hybrid floor construction)



330mm overall thickness @ 540kg/m²

260mm insitu r.c.
70mm precast r.c.

precast units are 9,0x1,8m with chamfer detail to all four soffit edges

design data:
imposed floor load 5,0 kN/m²
allowance for finishes etc. 1,25
selfweight 5,4

total sls 11,65 kN/m²
uls 17,31

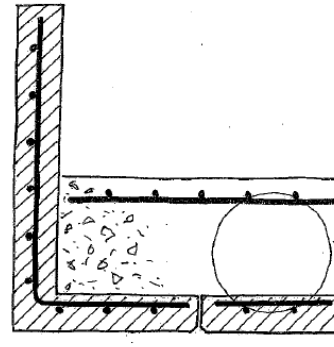
cladding perimeter load \times 10,0 kN/m

typical internal column load @ grd
say av. of 3/5 floors with l.w. roof
catch area 9x7,2m 65 m²
continuity $\times 1,1$ 72 m²
uls per floor 72x17,31 1250 kN
uls at grd (1250x3,5) + roof 4500 kN

typical perimeter column load @ grd
as above (1250 \div 1,1) / 2 2050 kN
allow for cladding 4x10x1,4x7,2 2450 kN

Section:

(of typical edge)

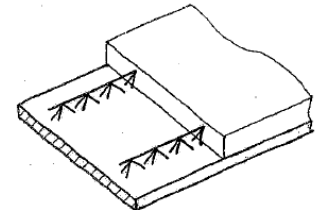


typical precast upstand edge detail which provides floor void closing detail.

precast 'L-shape' positively tied into insitu via bend-out bars cast into unit.

Isometric:

(of hybrid floor)



precast soffit units delivered to site with main top rebar mesh already fixed.

weight saving (concrete saving) hollow circular ball formers also built into delivered unit.

9,0x1,8m precast soffit units require prepping at say 3,0m centres until insitu is poured and 7 day strength achieved

more information:
buddleack tel 020 7877 8575
www.buddleack.co.uk

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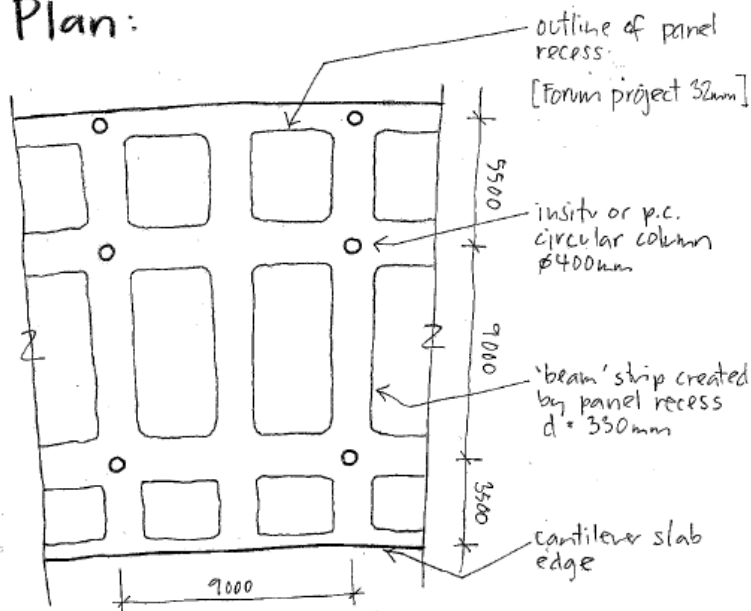
tel +44 (0)1223 369 220 fax +44 (0)1223 356 215
email: cambridge@whitby-bird.co.uk www.whitbybird.com

University of Sheffield LRC

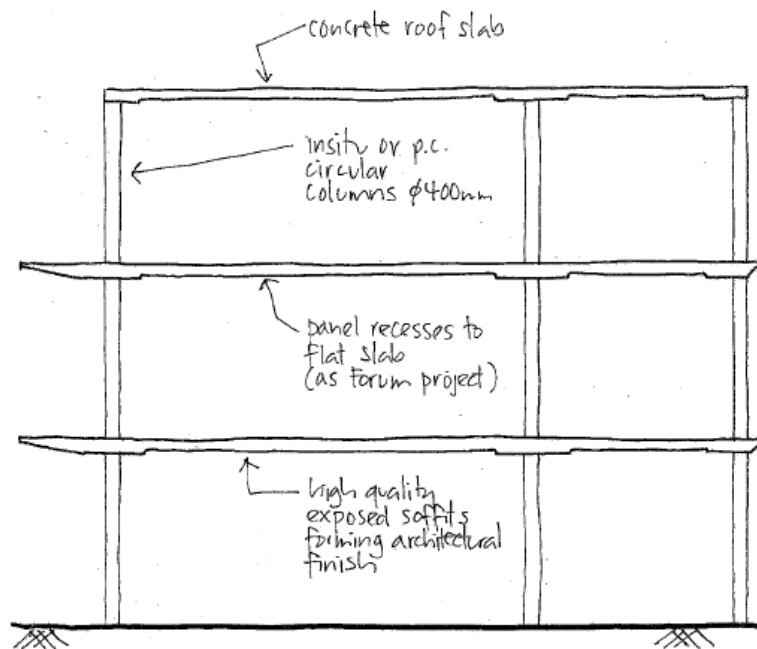
Hybrid Frame/Floor Solution in Concrete

Rev	Description	Date	By	Chk
Scale:	n.t.s.	Date:	March 2003	Drawn:
				SSmith
Drawing No.:	2975/SK/11			Checked:

Plan:



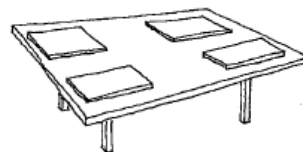
Section:



Notes:

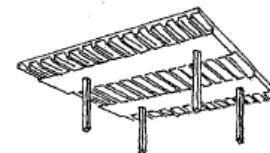
1. design loads: floor live $5.0 + 1.0 \text{ k/m}^2$
finishes 0.85
(raised floor, services)
2. materials: RC40 concrete
(note premium for exposed)
3. rebar quants are typical 150 kg/m^3
4. formwork layout are critical to soffitt finish (joint lines etc.)

Ideas:



'DRUPS' to reduce slab depth
 $d = 275/450 \text{ mm}$

POST TENSION



Rebar reduction
 $d = 275 \text{ mm}$

Trough slab reduce weight
 $d = 375 \text{ mm}$

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ENGINEERS

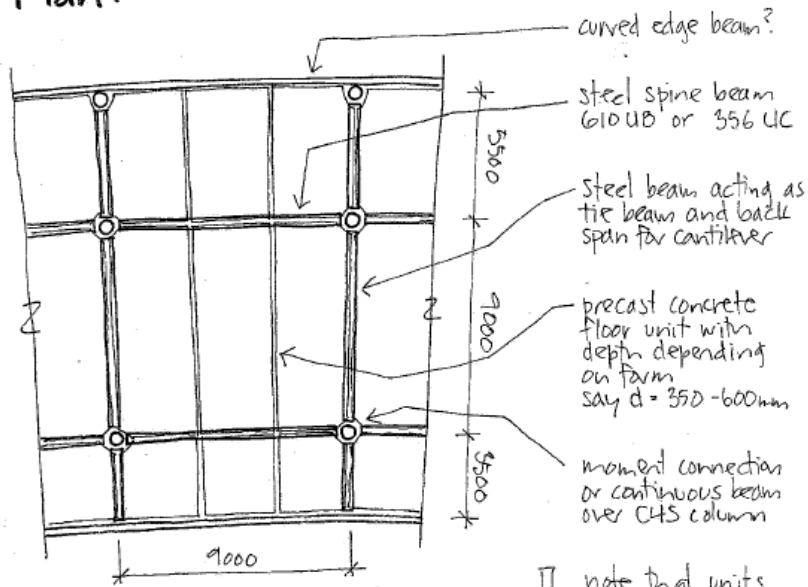
tel 01223 369220 fax 01223 358215 cambridge@whitbybird.com
www.whitbybird.com

NAPP Building, Cambridge

Outline Structure Scheme [r.c. insitu flat slab]

Rev	Description	Date	By	Chk	
Scale:	1:200 @ A3	Date:	Oct 2004	Drawn:	Checked:
Drawing No.: 3662/SK/001					Rev:

Plan:



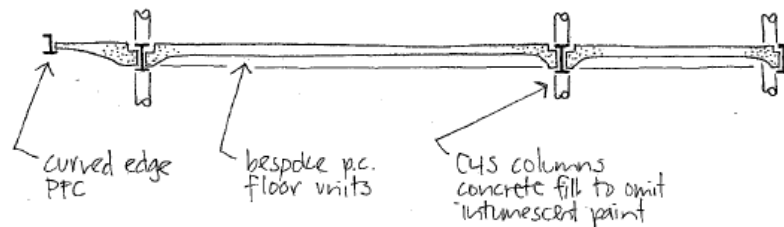
note that units may have to taper on plan to suit radius shape

Notes:

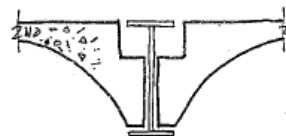
1. design loads: floor live 3,0+1,0 kN/m²
finishes 0,85
(raised floor, services)
2. materials: S355 steel
(note intumescent paint)
3. note high quality steel moulds for p.c. floor units
4. CHS steel columns could be r.c. filled to omit intumescent paint. [UEA library]

NAPP sprinklered building ruling means only 30min fire protection to structure

Section:

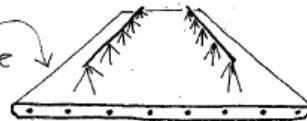


Ideas:

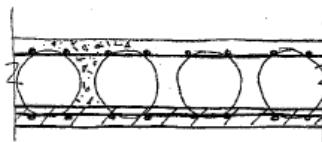


bespoke precast concrete floor units
high quality mould required, depth of unit depends on profile.
typically < 600mm

SCDC
Cambridge
UEA
Library



omni floor/core precast concrete units with insitu concrete topping
option 1: use industry ready units
option 2: develop own units



'bubbledeck' precast concrete units with insitu concrete topping
weight saving option with similar soffit profile to omni.

PROFILE SOFFIT

FLAT SOFFIT

FLAT SOFFIT

whitbybird
ENGINEERS

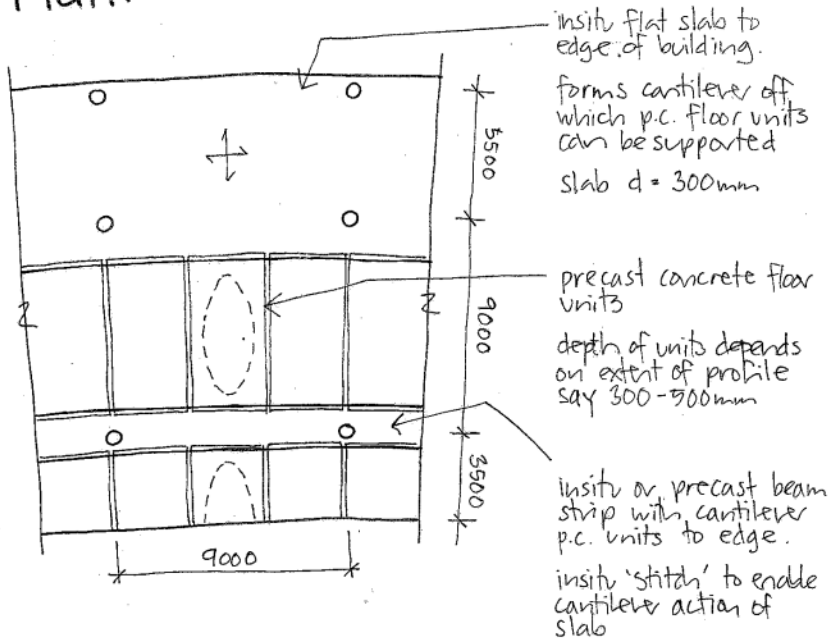
tel 01223 369220 fax 01223 358215 cambridge@whitbybird.com
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NAPP Building, Cambridge

Outline Structure Scheme [steel frame]

Rev	Description	Date	By	Chk		
Scale:	1:200 @ A3	Date:	Oct 2004	Drawn:	SSm	Checked:
Drawing No:	3662/SK/002				Rev:	

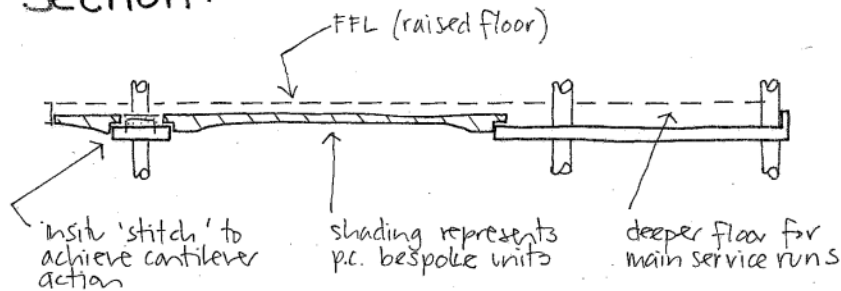
Plan:



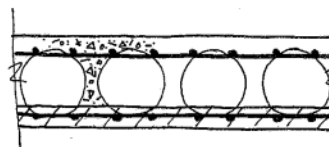
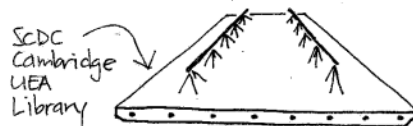
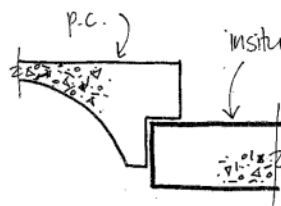
Notes:

1. design loads: floor live finishes (raised floor, services) $3.0 + 1.0 \text{ kJ/m}^2$
 9.85
2. materials: RC40 concrete (note premium for exposed)
3. rebar quant typical 150 kg/m^3

Section:



Ideas:



bespoke precast concrete floor units
high quality, mould required, depth of
units depend on profile
typically $< 500\text{mm}$

omni floor/core precast concrete units
with insitu concrete topping

option 1: use industry ready units

option 2: develop own units

'bubbledeck' precast concrete units
with insitu concrete topping
weight saving option with similar
soffit to omni.
steel moulds

PROFILE SOFTT

FLAT SOFFIT

FLAT SPIN

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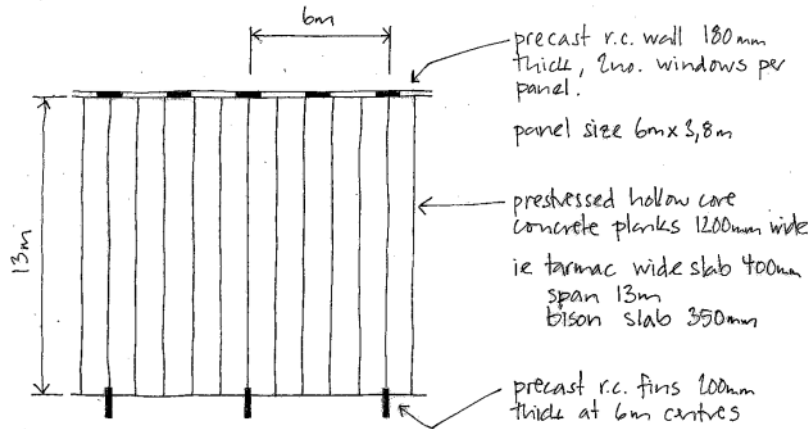
tel 01223 369220 fax 01223 356215 cambridge@whitbybird.com
www.whitbybird.com

NAPP Building, Cambridge

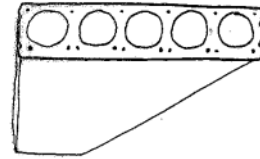
Outline Structure Scheme [hybrid insitu/p.c.]

Rev	Description	Date	By	Ch
Scale:	Date:	Drawn:	Checked:	
1:200 @ A3	Oct 2004	SSm		
Drawing No.: 3662 / SK / 003			Rev:	

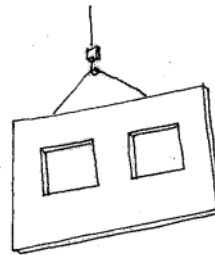
PLAN:



FLOOR:

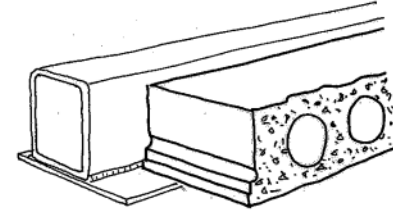


WALLS:

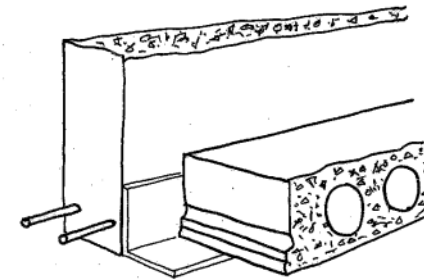


Detail:

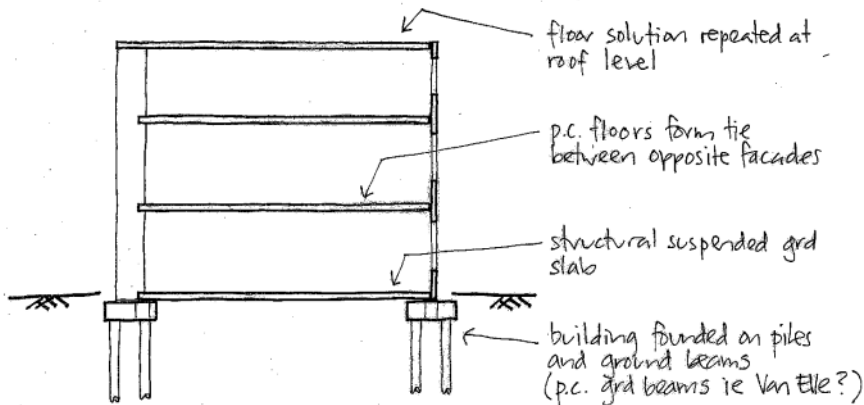
slimflor edge beam:



p.c. edge parapet:



SECTION:



NOTES:

design data: floor live load 3kN/m²
int partitions 1kN/m²
raised floor/services 0.75kN/m²

reducing span to 12m = 370mm Tarmac slab

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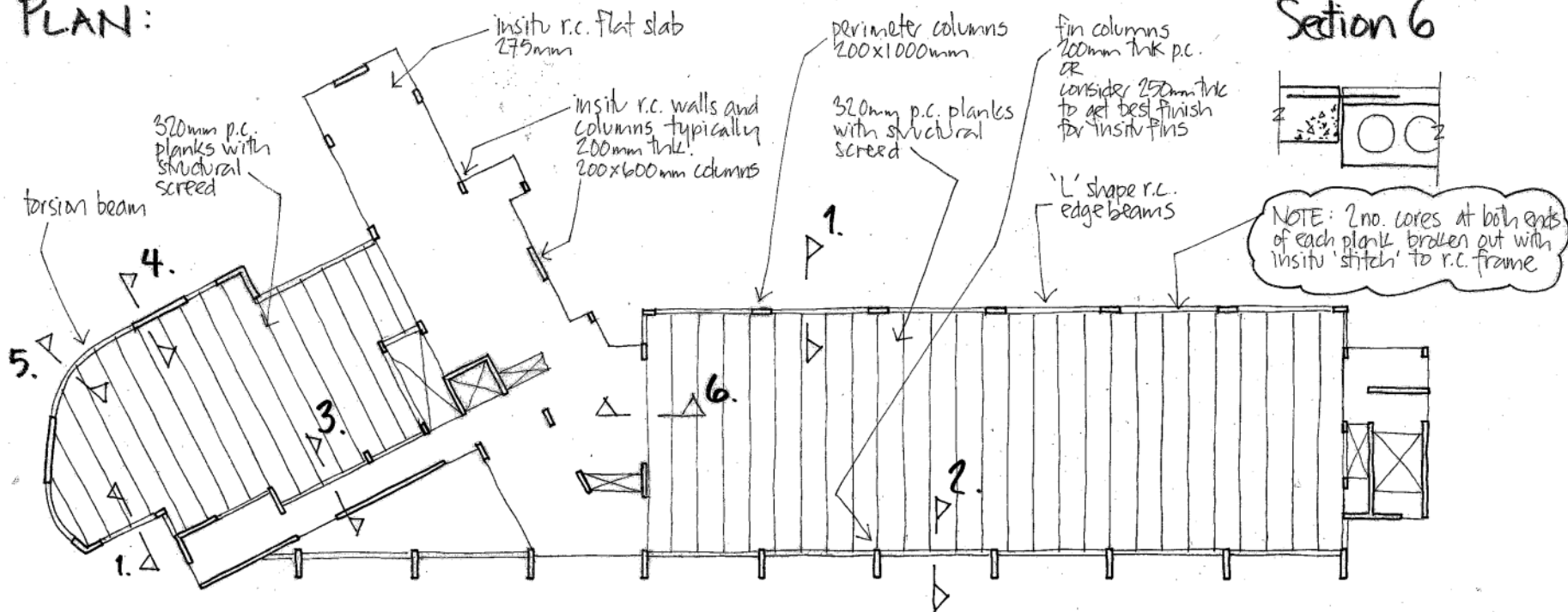
tel +44 (0)1223 369 220 fax +44 (0)1223 356 215
email: cambridge@whitby-bird.co.uk www.whitbybird.com

Longhurst Housing Offices, Boston

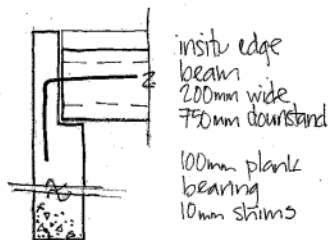
Structural Scheme Precast Concrete

Rev	Description	Date	By	Chk			
Scale:	1:100 @ A3	Date:	Jan 2004	Drawn:	SSW	Checked:	
Drawing No.:	3360/SK/002	Rev:					

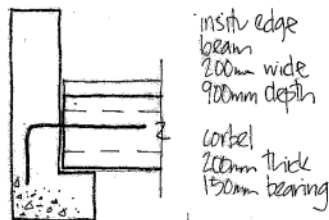
PLAN:



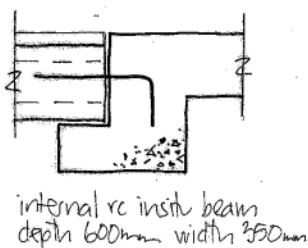
Section 1



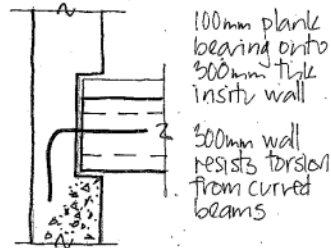
Section 2



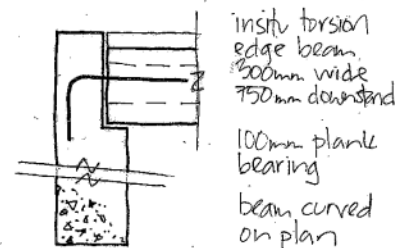
Section 3



Section 4



Section 5



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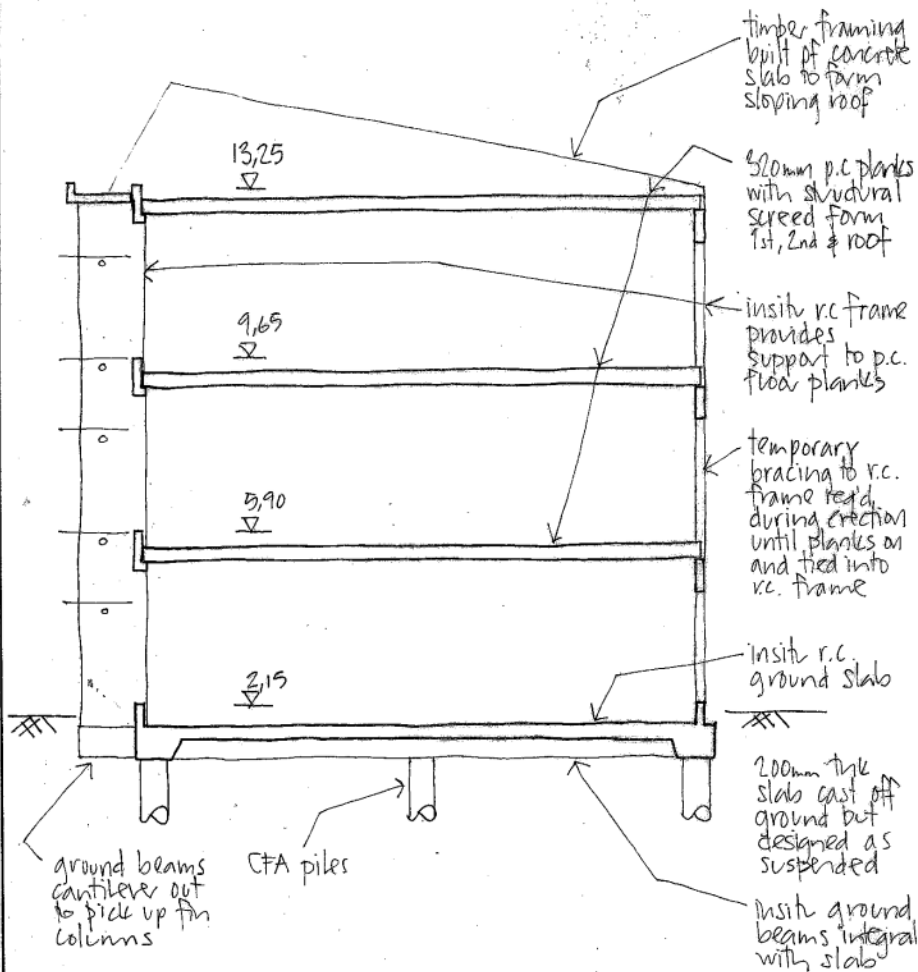
tel +44 (0)1223 369 220 fax +44 (0)1223 356 215
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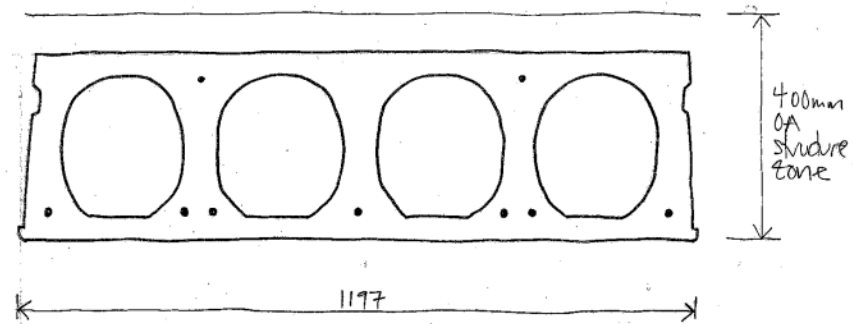
Structural Scheme, Insitu frame + Precast Floor

Rev	Description	Date	By	Chk		
Scale:	1:200 @ A3	Date:	April 04	Drawn:	SSM	Checked:
Drawing No:						Rev:
3360/SK/004						

Section: (1:100 @ 43)

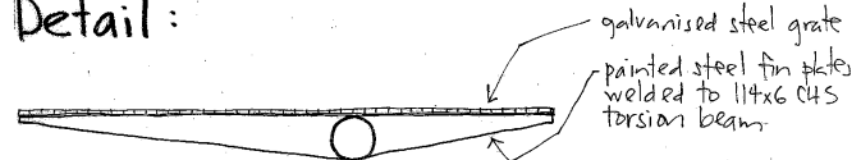


Detail: (nts)



section through 320mm deep TARMAC prestressed plank
section indicates no. of cores and position of prestress wires

Detail:



structural solar shading to south facade

typical deflections under 3 man load:

1. vertical deflection $\frac{2wL^4}{384 E I}$ self weight $< 10mm$ 3man $< 10mm$
2. twist deflection $\frac{T L}{G I_p}$ 3man $\phi = 0,01rads$ $< 10mm$

note: torsion at ends of CHS is resisted by insitu r.c. fin column. torsion fixing into concrete required.

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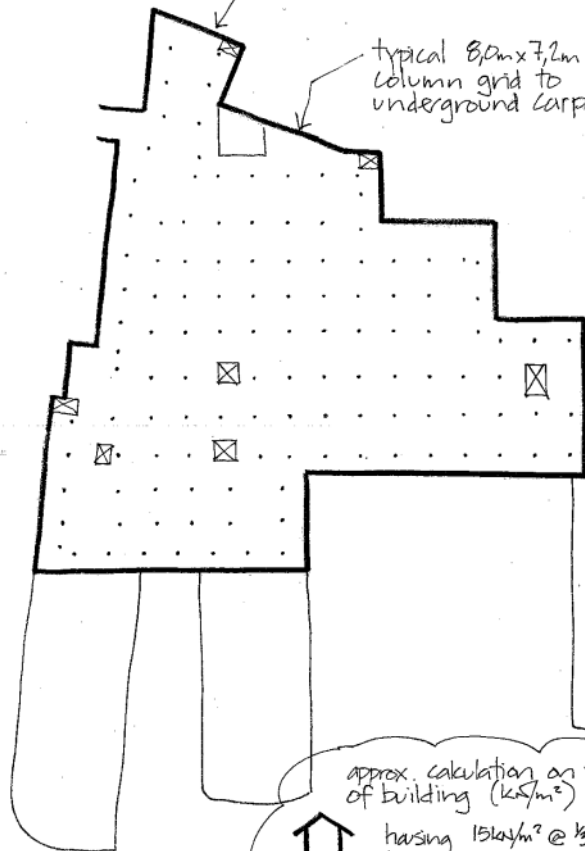
Structural Outline Sections

Rev	Description	Date	By	Chk
Scale:	1:100 @ 43	Date:	April 04	Drawn:
Drawing No:	3360/SK/005	Checked:	SSm	Rev:

Plan:

outline of basement welded sheet pile wall or 300mm r.c. wall

typical 8.0m x 7.2m column grid to underground carpark



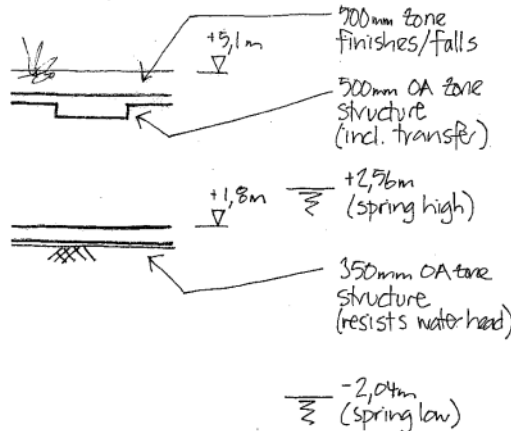
Note: car park entrance is at +3.25m ie flood gate?



approx. calculation on weight of building (kg/m²)

having 15.4m ² @ 1/3	5 kg/m ²
landscape	3
deck structure	8
lower slab	8
	<hr/> 24 kg/m ²

Section:

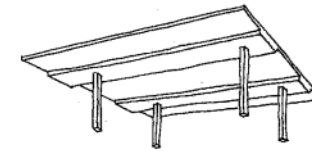


Notes:

1. Allow for high grade concrete (ie C50 and/or additives - pudlo) to resist salt attack
2. Allow for 150 kg/m² high yield rebar for r.c. works
3. Note basement slab provides ex daily resistance against high tide water head to u/s of lower slab (1m)
4. For major flood events say WL +3.8m piled foundations will have to aid against building floatation (piles in tension)
5. Deck supports loads as follows:
live load 5 kg/m²
landscape/finishes 9 kg/m² (ie 500mm soil + screed)

Structure:

Deck Slab (Band Beam)

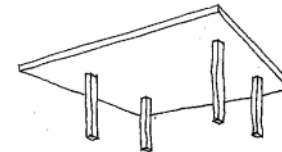


Overall zone allow: 425mm landscaped 500mm transfer

250mm flat slab spanning between wide downstand beam (w=2400mm)

Structure s.w. = 800 kg/m²

Deck Slab (Flat Slab)



Overall zone allow: 350mm landscaped 500mm transfer

Lower Slab



Allow for 350mm flat slab supported by (and held down by) piles.

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Brightlingsea Marina

Outline Structural Concept Basement Slabs

Rev	Description	Date	By	Chk
Scale:	n.t.s.	Date:	March 04	SSm
Drawing No:	3433/SK/003	Rev:		

Plan:

(1:500 @ A3)

Hybrid insitu/PC concrete frame
9m x 7.2m typical column grid

200mm thick walls to insitu cores

typical $\phi 450$ mm
r.c. columns
9m x 7.2m grid

340mm thick
slab

lightweight steel
link bridge

upstand edge beam
to slab read

structure built over
live train sub-station

'saw-tooth' edge
requires 3m+ slab
cantilever

Building Iso:

(n.t.s.)

open and covered roof plant
enclosure provided by steel
framing

r.c. roof to
occupied areas

'saw-tooth'
profile by
steel frame

facade cladding
by lwt steel and
steel frame

retaining walls
req'd to perimeter
to support lower
ground level

Section:

(n.t.s.)

roof plant on r.c. slab
in lwt steel enclosure

5 storey steel structure
forming framing to
'saw-tooth' profile

hybrid insitu/pc concrete
frame

mudstone provided founding
layer to building
(piles OR pads)

Foundation strengthening or
temp. works req'd to support
retained buildings

Section: (n.t.s.)

340mm thick 'bubbedeck'
r.c. floor system.

high quality bespoke
concrete soffits (flat)

270mm insitu topping
70mm p.c. permanent
formwork

S.W. $\approx 565 \text{ kg/m}^2$

Design Data:

imposed floor load
allowance for finishes
(raised floor & services)

5 kN/m^2
 985 kg/m^2

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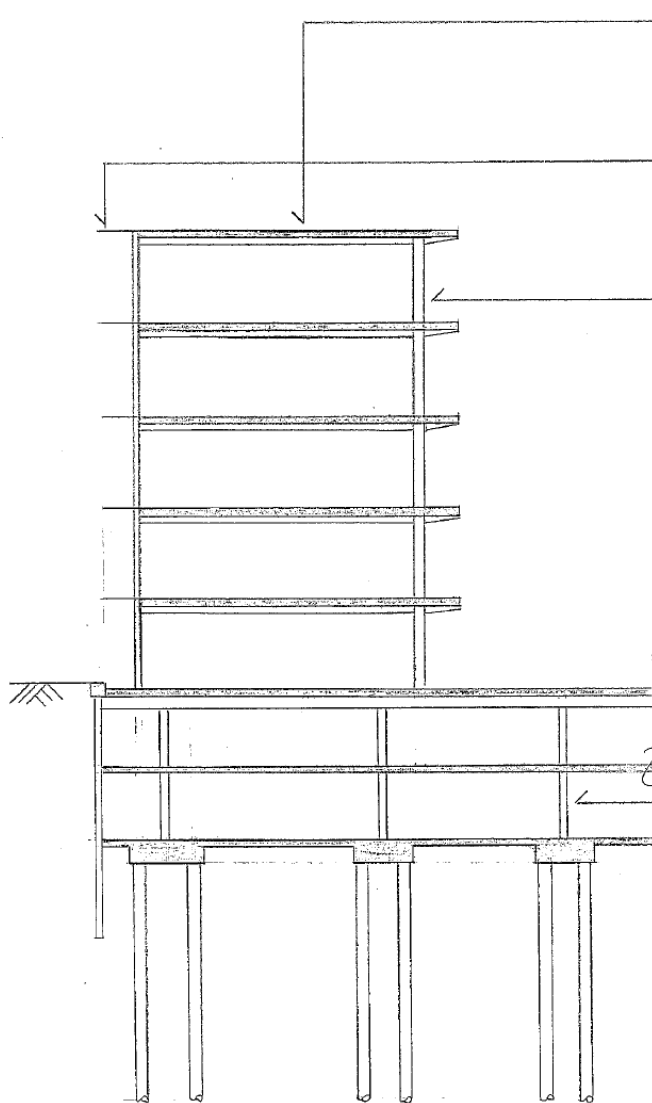
University of Sheffield, LRC

Outline Structural Description

Rev	Description	Date	By	Chk			
Scale:	n.t.s.	Date:	March 04	Drawn:	SSm	Checked:	
Drawing No.:	2973/SK/032					Rev:	

Building Section 1:200

Structural Philosophy



Roof construction:
Similar band beam floor plates to achieve required thermal mass and support green roof construction

Balcony construction:
a series of metal cantilevers will form exposed external balconies. cantilevers support a series of shading devices & balustrade by tension wire

Superstructure frame:
reinforced concrete frame with exposed concrete surfaces forming architectural finishes.
exposed thermal mass of structure contributes to environmental strategy to building.
structural grid to office wings 6x12m with 1.9m cantilever
external perimeter system of concrete columns and beams that support internal floor plates via thermal break connection.
concrete band beam floor plates with options for insitu, post tension, precast or hybrid solution.

Transfer structure:
read at ground floor to transfer bldg grid (12mx6m) on to car park grid (7.5m x 7.8m).
Transfer depth approx. 650mm + 290mm slab

Sub structure frame:
typical car park grid 7.5x7.8m
275mm thick flat slab construction with notional drain falls.
40 kg/m² rebar
flush soffit aids services installation & air flows for natural ventilation.

Groundwater:
further monitoring of levels req'd in order to test viability of 2nd basement level.
S.I. states 20mAOD g.w.l.

Lower basement slab:
built off weathered chalk which require some form of piling mat, trackable surface which doubles up as lower slab 'sub-base' due to possibility of solution features
lower slab is designed as suspended ie 300mm thick. 50 kg/m² rebar
slab designed to resist water uplift pressures & external tanking to underside notional drain via slab to falls

Building foundations:
piled foundations support the main building loads.
pile installation methods will require consultation with environment agency due to chalk aquifer & local strategic abstraction point
temporary sleeving of piles and placing of concrete below water table required
low risk of solution features highlight in S.I.

Retaining walls:
sheet piles wall provide both temp. & permanent retaining to the basement.
pre-ageing of the piling line is likely in order to drive piles through dense deposits.
silent piling techniques may be required in city centre.
pile joint treatment welded to omit water long term

Temporary works:
sheet pile walls will require lateral restraint in both temp. & perm. case.
in temp. case this is provided by walings, raking props & thrust blocks.

Ground conditions:
typically varying depth of dense deposits over chalk to depth. chalk head varies from 1.3m to 6m below extg. ground level.
depth excavations likely to encounter ground water inflows